Available online at www.sciencedirect.com
ScienceDirect
Procedia Economics and Finance 15 (2014) 56 – 63
Procedia
Economics and Finance
www.elsevier.com/locate/procedia

Perspectives of the quantitative and structural evolution of tertiary education in Romania

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Abstract

The paper deals with the problems of development of tertiary education during the last decade and the perspective in the second decade of the 21-st century. Therefore, firstly, it is analysed the evolution of the number of students and their distribution within specialization fields in European Union. Also, a special attention is paid to identification of characteristic features of the tertiary education in Romania during the period of integration in European Union. The second part of the paper is dedicated the projection of tertiary education supply in Romania from quantitative and structural point of view. In this context, there are presented the constraints and opportunities for the modelling the evolution of tertiary education generated by demographic dynamics and the convergence with the students distribution on specialization fields registered in European Union as a whole.

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Keywords: tertiary education; projection methods; structural changes

1. Introduction

In the last two decades, evolutions on social and cultural levels were profoundly influenced not only by phenomena as the transition to a market economy, the increase of globalization of economic activity and the implementation of information communication technologies on a larger scale, but also enhancing the role of higher education institutions in the formation and development of human capital. On European level, the

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Selection and peer-review under responsibility of the Emerging Markets Queries in Finance and Business local organization
doi:10.1016/S2212-5671(14)00446-8

importance of the role of tertiary education in the valorisation of human capital in a context of a more dynamic social and economic environment was revealed since 1988, when Bologna adopted Magna Charta Universitatum. In this document were set the fundamental principles of an Europe of Higher Education, in order to ensure, in the context of academic autonomy, a greater involvement of academia in supporting the advance of scientific knowledge, in promoting social mobility and cohesion, and in a better adaptation of the manpower to major changes prefigured in the productive system. In 1999, in Bologna was adopted a statement that came to support the document adopted a decade ago and initiated a series of reforms aiming at transforming the Higher Education in Europe in one of the factors of rapid increase of competitiveness and social mobility. Results of the steps taken for the reform of that component of education and professional training system were analysed during meetings of education ministers of European Higher Education Area. The most recent meeting was held in Bucharest, in April 2012, when was highlighted the major role of academic environment in ensuring the economic recovery of European countries and a better utilization of labour resources. The implementation of reform process mentioned before, has led to a number of changes not only in terms of the dynamic of student groups, but in their distribution in areas of specialization.

2. Trends of Tertiary Education's evolution in European Union

In the last decade, the number of students in tertiary education increased continuously in the countries of European Union. Between 1998 and 2009, the rhythm of average annual increase of student's number, that can be consider as the main indicator of the demand for higher education, was 2.39% in the European Union. It should be noted that the dynamic of the indicator has varied during the analyzed period. Between 1998 and 2003, the rhythm of average annual increase was 3.42%, and 1.54% between 2003 and 2009. The slowdown trend of growth number of students was manifested not only in most member countries of the European Union, but also in other developed countries, such as USA. One of explanations of this trend is the manifestation of demographic aging, which reduced to a considerable extent the demand for tertiary education. It is important to consider the fact that the proportion of people with higher education reached a relatively high percentage in the number of active population, which contributed to the shaping of a trend of limited demand for higher education. Exception to the rule were registered in the Czech Republic, Denmark, Germany, Holland and Austria, where the rhythm of growth in the number of students increased. Between 2002 and 2006, the number of students in the field of "science, mathematics and computer" has increased significantly, but it did not exceed a proportion of 10%. There are still large differences of the relative importance between countries. So, in Latvia, Romania and Slovenia, the value of that indicator is 5%, while in Ireland, Austria and United Kingdom is about 12%. In 2006, about 35% of people with higher education graduated social sciences courses, business studies and law schools. The share of studies related to health or social care was 14.40%, while the studies in engineering and humanities were about 12% for each fields. In a few countries, like Slovenia, Latvia and Romania, the share of studies of social sciences, economics and law was over 50%. Graduates of technical studies represent more than 15% in ten countries, with the maximum of 19% in Austria and 34.9% in Lichtenstein. The proportion of graduates of health and social care studies is over 20% in Sweden, Norway, Germany, Denmark and Portugal. In 2007, in the European Union, 30% of the people aged between 30 and 34 years completed undergraduate and graduate studies, a percentage that is twice as high as the percentage of people aged between 55 and 64 years that was 17% (Key Data in Education, 2009). Proportions over 40% were in France, Belgium, Denmark, Ireland, Cyprus, Finland and Sweden, while the proportions under 20% were specifically for Portugal, Czech Republic, Slovakia, Italy and Romania. About 60% of tertiary education degree holders are women. In all member countries of European Union, the number of women exceeds the number of men in terms of higher education in the education field, the share being at least 70%, except Malta. Proportions over 90% were registered in Estonia, Italy and Latvia. In contrast, the share of men in the field of "science, mathematics and computers" is over 80%.

In the last decade, can be observed an increasing trend in the number of students and graduates in the field of "science, mathematics and computers". A significant contribution to this evolution had the objective set in the programmatic documents of European Union, which aimed to increase the number of students in this field to 15% between 2000 and 2009, and to decrease significantly the gender gap. In numerical terms, the objective has been achieved. This means that the number of students increased to 39%, but the gap between genders remains significant, given that the share of women in the total number of students was 32% in 2009 (Mejer, Turchinetti, Gere, 2011), being stable during the first decade of the 21st century. In these circumstances, the share of persons with higher education in the field mentioned before increased from 8.8% in 1998 to 12.3% in 2003 and to 14.3% in 2009. Romania is one of the countries were the value of the indicator was in 2009 (20%) among the highest in the European Union.

In the analysis of the weight of the number of persons with higher education in relatively young age groups of active population (20-29 years) is necessary to take into account the effects of BOLOGNA process. These contributed to the increase of the number of people with university education in the analysed period by introducing undergraduate and master studies. The people mentioned above are still in various forms of tertiary training. The structural changes in the last decade in most of member countries of European Union and of European Higher Education Area were made in the context of maintaining the average age of entry into educational system, but also an increase of mean and median age of students. The development is a reflection of the trend of extending studies and is manifested especially in the Nordic countries and in the United Kingdom. Consequently, in 2010 the median age of students in tertiary education was 20.3 in Ireland and 25 in Sweden. It is worth noting that values above average registered in the European Union, were registered not only in Scandinavian countries, but also in Germany, Austria, Greece and Romania (EUROSTAT, 2012). The trend of increasing average age of students should be linked with the extent of lifelong educational forms (lifelong learning) and with the efforts of universities to adapt to the retraining requirements of some persons in the age group of 30-40 years.

The evolution of the number of students in the last years in necessary to be linked with the objectives of the strategy for development of human capital in Europe, which stipulate that in 2020 among people aged 30-34 year, the proportion of those with higher education will be at least 40%. To achieve that objective is important not only the access of younger generation to tertiary education, but also to ensure the conditions for graduation. In this context, in 2010 the number of tertiary education graduates in the European Union was approximately 4.5 million people, which represented 22.7% of enrolled students.

3. The evolution of tertiary education in Romania, in the European Context

In Romania, in the last two decades, the number of students has increased in an alert rhythm, during intense transformation of economic, social and cultural environment. As stated above, between 1998 and 2009, Romania recorded the highest growth rate of the number o students among member countries of the European Union. It is important to note that the explosive growth of private tertiary education had a significant contribution to this development. The number of private universities and their policy of massive increase of student's number resulted the increasing of the offer of tertiary education. Under these conditions, the total number of enrolled students in 2010 was, according to EUROSTAT, approximately 1 million, which led Romania to become the seventh member country of the European Union, after Germany (2.556 million), United Kingdom (2.479 million), France (2.245 million), Poland (2.149 million), Italy (1.980 million) and Spain (1.879 million).

The dynamic of the number of students was accompanied by a series of structural changes of which the most important are: a) constant increase of the number of female students; b) increasing the relative importance of economic studies, law studies and other social sciences, in the same time reducing the relative importance of

of technical and engineering studies and health studies of academic specializations. In these conditions, in 2010, the share of social science, economic and law studies was 55%, significantly higher than the one recorded in the whole European Union and also in the countries with the most enrolled students. (Table 1)

Table 1. The structure on areas of specialization of students and graduates of tertiary education in some countries of EU, in 2010

Country	Education sciences	Humanities & arts	Social sciences, buss.& law	Science, mathematics & computing	Industrial engineering & construction	Agriculture & veterinary	Health & social care	Services
European Union	9.9 (9.6)	12.2 (11.5)	34.0 (35.7)	10.1 (9.2)	14.4 (12.7)	1.8 (1.6)	13.6(15.1)	4.0 (4.2)
Germany	7.4 (9.3)	13.7 (16.4)	26.2 (22.4)	14.2 (12.6)	16.4 (13.0)	1.4 (1.5)	17.9(21.5)	2.8 (3.0)
United Kingdom	14.1 (11.0)	16.1 (16.4)	27.6 (30.9)	13.3 (12.7)	8.5 (9.6)	1.0 (0.9)	17.7(16.6)	1.7 (1.4)
France	2.6	14.2	37.2	12.3	13.2	1.2	15.9	3.4
Poland	5.2 (8.0)	9.2 (16.3)	39.7 (42.6)	8.1 (6.8)	13.2 (8.9)	1.9 (1.7)	16.3 (8.9)	6.4 (6.2)
Italy	4.6 (1.5)	14.5 (10.3)	33.8 (41.6)	7.7 (10.6)	15.7 (15.6)	2.1 (1.5)	11.6(14.9)	2.8 (4.0)
Spain	11.5 (8.8)	10.6 (13.2)	31.4 (30.3)	9.1 (12.1)	17.3 (15.4)	1.7 (4.6)	12.6(12.6)	5.8 (3.1)
Romania	1.5 (1.5)	7.8 (8.3)	55.0 (60.0)	4.9 (4.8)	17.9 (12.3)	2.1 (1.6)	7.5 (8.8)	3.3 (2.7)

NB: The first number represents the percentage of the group of academic specialization from the total number of students in tertiary education. In parentheses is the weight of specialization groups in the total number of students in tertiary education.

Source: Tertiary education statistics, Explained Statistics, EUROSTAT, September 2012.

Consequently, most of the other specialization areas have lower share in the total number of students, compared with the situation in the European Union. Exceptions are technical studies (industrial engineers and constructions and agriculture and veterinary), where the proportion is higher in Romania compared to the whole European Union. The differentiation of the distribution of student on specialization areas between Romania and the European Union is not negligible; the angle between the structure vectors (of weights) is 21.8˚. It can be seen that the distribution of students per specialization areas is greater compared with the United Kingdom and Germany[†]. The distribution on specialization areas of the students admitted in the first year and then graduates is correlated in a very small extent with the situation of the labour marker of Romania. A proof is that many graduates do not work in the fields for which they are specialized and that there is a relatively high proportion of people that enter in a second cycle of academic education. The migration of a large proportion of graduates should not be ignored during analysis.

These developments show that the development of tertiary education in Romania was stimulated mainly by the action of some social and cultural factors, and in the second place by the demand for qualified personnel generated by productive apparatus or the mutations that have occurred in society. In fact, for a part of the population, especially for younger persons, the accession to the academic studies was and still is seen as a form of social and cultural emancipation and as an investment that ensures a long-term job. For many graduates of various academic trainings, finding a job in the domains for which they studied was not a major concern. On the other hand, it can be observed the fact that the distribution of students on specialization areas differs from one of graduates. Thus, the share of the number of graduates is higher than the total number of students in the areas of specialization where the studies last 3 years, the number of females is higher and the issue is mainly related to humanities, art, economic and social studies. In contrast, the share of students is lower of the number

[†] In 2010, the values of the angle between vectors of distribution structure of groups of students in professional areas were the followings: 32.8° between Romania and Germany; 36.1° between Romania and United Kingdom; 20.6° between Romania and France; 18.0° between Romania and Poland; 22.6° between Romania and Italy; 24.1° between Romania and Spain.

of graduates, in the case of studies in industrial engineering and construction, agriculture and veterinary. The studies in these specialization areas last more than 3 years and the graduation requirements are higher. It should be noted that the type of asymmetry between the weights of specialization areas in the number of students and the number of graduates are encountered not only in Romania, but also in the European Union and in the European countries with a large number of students.

In these circumstances, one of the issues that need to be resolved on long-term is to ensure a dynamic number of students and graduates of Underground Studies, in accordance with demographic evolution in Romania and the objectives assumed in the Strategy 2020. Another problem that needs to have an adequate response is resizing the number of students to obtain a convergent evolution with a trend manifested in the European Union. Therefore, it is useful to build a model of quantitative projection of the offer of Undergraduate Studies and an estimation of the number of graduates of academic specialization areas. In the next section of this paper will be presented a projection model.

4. A model for the calculation of the number and structure of students admitted in the first year and of the graduates of Undergraduate Studies

The proposed model to determine the number of students admitted in the first year of Undergraduate Studies and the number of graduates on areas of specialization involves the following steps:

(1) An exogenous determination of the number of high school graduates in the year "t" (NGHSt)

(2)The estimation of the ratio between the total of students admitted in the first year of Undergraduate Studies and the number of high school graduates in the year "t" ($RSGH_t$)

To estimate the ration mentioned above will be used a method of exponential smoothing values in the last 4 years. Taking into account other specialized works, will be consider a coefficient of 0.8 for the weight of the coefficient of year "h-1". Under these conditions, we can write:

$$RSGH_t = 0.8 * (\sum_{k=1}^{4} * (1-0.8)^{k-1} * RSGH_{t-k}$$

(3)The formula for calculating the total number of students admitted in the first year of Undergraduate Studies ($NSYI_t$):

$$NSYI_t = NGHSt * RSGH_t$$

(4) Calculating the share of specialization groups in the total number of students in the first year of Undergraduate Studies in the year "t"

In determining the distribution of students in the first year of Undergraduate Studies will be adopted the assumption that on long term, the distribution of students on areas of specialization will tend to equalize the distribution of students on specialization areas, in the European Union in 2010 ($shspecj_{UE2010}$). It will be assumed that the speed of the transition to equilibrium is equally to the tendency to preserve the current state at a time. Under these conditions, we can write:

$$Shspecjt = Shspecjt\text{-}1 + 0{,}5(ShspecjUE2010 - Shspecjt\text{-}1)$$

(5) The formula for calculating the number of students admitted in the first year of Undergraduate Studies on specialization areas ($NSYIspecj_t$):

$$NSYIspecj_t = NSYI_t * Shspecj_t$$

(6)The formula for calculating the success rate of the Undergraduate Studies on areas of specialization (Rsspecj):

$$Rsspecj = (\sum_{k=1}^{n} NGHj_{k+d}) / (\sum_{k=1}^{n} NSY1j_k)$$

Where:

n= the number of years of the benchmark

NGH_k= the number of graduate of Undergraduate Studies on area of specialization "j" in the academic year "k"

d= duration of Undergraduate Studies in the specialization area "j".

(7) The formula for calculating the number of graduates of Undergraduate Studies on areas of specialization, on each academic year:

$$NGHj_t = NSYIspecj_{t-d} * Rsspecj$$

5. Estimation on area of specialization, of the number of students admitted in the first year of Undergraduate Studies and the number of graduates in the period between 2013 and 2021

Based on the estimates presented by F.M. Pavelescu and V. Vasile (2013) regarding the number of high school graduates ($NUGHS_t$) and on the calculated values for the $RSGH_t$ Report, was simulated in a first phase, the structure on specialization areas of the evolution of admitted students in the first year. On this basis, could be anticipated a decrease with approximately 10% of the number of students admitted in the first year, from 140,000 to 126,300 between 2013 and 2020 (Table 2). The decrease of the number of students will be mainly because of the decrease of the number of high school graduates.

Table 2. Estimation of the total number of students admitted in the first year of Undergraduate Studies and the structure on areas of specialization, in the period between 2013 and 2021

Academic year	$NUGHS_t$	$RSGH_t$	$NSYI_t$	The structure on areas of specialization of students admitted in the first year of Undergraduate Studies							
				A	B	C	D	E	F	G	H
2012-2013	141561	1.00870	142792	5,7	10,0	44,5	7,5	16,2	2,0	10,6	3.5
2013-2014	138986	1.00714	139979	7,8	11,1	39,3	8,8	15,3	1,9	12,1	3.7
2014-2015	135554	1.00585	136347	8,9	11,7	36,6	9,5	14,8	1,8	12,8	3.9
2015-2016	156419	1.00451	157124	9,4	11,9	35,3	9,8	14,6	1,8	13,2	4.0
2016-2017	153188	1.00322	153682	9,6	12,1	34,7	9,9	14,5	1,8	13,4	4.0
2017-2018	124968	1.00194	125210	9,8	12,1	34,3	10,0	14,5	1,8	13,5	4.0
2018-2019	125189	1.00064	125269	9,8	12,1	34,2	10,1	14,4	1,8	13,6	4.0
2019-2020	125259	0.99936	125179	9,8	12,2	34,1	10,1	14,4	1,8	13,6	4.0
2020-2021	126546	0.99807	126302	9,9	12,2	34,0	10,1	14,4	1,8	13,6	4.0

NB: A= Educational sciences; B= Humanities & arts; C= Social sciences, business & law; D= Science, mathematics & computing; E= Industrial engineering & construction; G= Agriculture & veterinary; G= Health & social care; H= Services.

Considering the proposed algorithm in the model mentioned above, could be anticipated that starting with the academic year 2018-2019, the structure on specialization groups of the students admitted in the first year of Undergraduate Studies in Romania, will be the same with the one registered in the total number of students in European Union. As a result of the change of the distribution on areas of specialization between 2013 and 2020, the number of students admitted in the first year of Undergraduate Studies will increase in the areas of educational studies, mathematics and computers to the annual average rate 1.93%. In the field of health and social care, the annual average rate will be 0.49% and 0.22% (Table 3).

Tabel 3. Estimation of the number of students admitted in the first year Undergraduate Studies on specialization groups, in the period between 2013 and 2021

Academic year	Educational sciences	Humanities & arts	Social sciences, buss.& law	Science, mathematics & computing	Industrial engineering & construction	Agriculture & veterinary	Health & social care	Services
2012-2013	8139	14279	63542	10709	23061	2784	15065	5212
2013-2014	10918	15538	54942	12318	21382	2625	16902	5354
2014-2015	12067	15884	49937	12885	20230	2505	17504	5335
2015-2016	14730	18737	55484	15359	22970	2858	20770	6216
2016-2017	14811	18538	53260	15272	22298	2781	20608	6114
2017-2018	12231	15190	42982	12544	18099	2260	16909	4995
2018-2019	12319	15240	42797	12601	18073	2258	16977	5004
2019-2020	12352	15250	42664	12618	18043	2255	16995	5004
2020-2021	12483	15398	42994	12744	18196	2274	17162	5050
Rate of growth	1,93	-0,13	-3,44	0,49	-2,28	-2,03	0,22	-0,83

A decrease of the number of students admitted in the first year of Underground Studies will be registered with an annual average rate of -3.44% in the following fields: social sciences, economics and law. In the field of technical industrial studies and construction the average annual rate will be -2.28% and in the field of agriculture and veterinary will be 2.03%. In these conditions, could be made a simulation of the number of graduates on areas of specialization for the period between 2014 and 2021. It should be noted that the estimated success rate of undergraduate studies faces a number of difficulties, especially because of the implementation of Bologna Reform in the Higher Education in Romania. Under these conditions, is not enough time to determine the value of that indicator, which could reduce the influence of incidental factors and to reflect a clear trend that could be extrapolated.

Table 4. Estimated number of graduates of Undergraduate Studies on specialization groups, in the period 2013 - 2021

Academic year	Educational sciences	Humanities & arts	Social sciences, buss.& law	Science, mathematics & computing	Industrial engineering & construction	Agriculture & veterinary	Health & social care	Services
2012-2013	35775	7937	2090	45518	25925	58990	2823	
2013-2014	34287	9204	2027	33334	15618	48657	2633	
2014-2015	29550	9728	2007	26851	13522	37879	2340	
2015-2016	26801	10371	1944	28948	8870	37057	2081	
2016-2017	24707	9870	1457	29587	10408	36178	1929	
2017-2018	23373	7818	1203	29407	11017	35167	1825	
2018-2019	22354	6725	1061	34228	11127	40484	2072	
2019-2020	25523	6093	1160	33644	13051	39577	2011	
2020-2021	24848	6757	1103	27478	12876	32236	1632	
Raspecj	96.6894	83.1396	84.0433	83.0640	69.4915	66.8703	84.9221	63.4164

For these reasons, for ensuring an increase of the quality of educational offer and for a medium and long-term prediction, is necessary to take action in order to increase the percentage of graduates in Undergraduate Studies Cycle. To achieve this, it is important to improve the methods of selection and guidance of candidates for the first year of study, but also supporting improvements of data systems and statistical survey about developments in Higher Education. In this way, could be identified the causes of the dropout extent of university studies and how graduates of Undergraduate Studies enter on the labour market or continue their studies in Masters Programs, in the same or other specialization.

Acknowledgements

This paper is supported by the project "Evaluarea și prognozarea cererii de muncă potențiale pentru absolvenții de învățământ superior, în structură ocupațională, la orizontul anului 2020, în vederea dezvoltării corespunzătoare a politicilor privind instruirea de nivel universitar", sectoral project MEC-ANCS 4/2011-Coordinator INCDMPS, beneficiary Ministerul Educației Naționale-Romania, **www.prevedu.ro**

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